WATER RESOURCES RESEARCH GRANT PROPOSAL

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Title: An Economic Analysis of Groundwater Nitrate Pollution Control in Dairy-Intensive Watersheds

Project Type: Research

Focus Categories: Law, Institutions, and Policy, Groundwater, Nitrate Contamination

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Abstract

California's dairy industry grew steadily during the 1990s and currently employs around 16,000 people and produces around $4 billion annually in milk sales. In 2002, the state produced 35 billion pounds of milk, up from 20.9 billion pounds in 1990. During the same period, the total number of milk cows increased from 1.1 to 1.6 million and the average production per cow increased from 18,456 to 20,904 pounds per year. Meanwhile, the number of dairies has declined from 4000 in 1993 to 2150 in 2002. These structural shifts by the industry have led to continuing concentration of dairy operations, particularly in the Central Valley and Chino Basin.

This consolidation of operations poses a dilemma for dairy farmers and policy makers. Consolidation has enabled farmers to continue to meet public demand for a safe, reliable and inexpensive supply of milk products by taking advantage of inherent economies of scale in dairy production. But consolidation also has created significant problems regarding waste management: whereas the typical dairy in the 1970s was able to dispose of its manure economically on nearby cropland at or below agronomic rates, many

modern California dairies produce more waste nutrients than can be utilized locally as fertilizer. Currently, the most economical "solution" continues to be over-application of manure, which can produce adverse environmental and health effects as excess nutrients, salts and other waste components migrate through local and regional hydrologic systems.

On a national level, the United States Environmental Protection Agency (USEPA) has determined that polluted runoff from animal feeding operations (AFOs), though regulated under the Clean Water Act, continues to be such a significant source of impairment for rivers, lakes, wetlands, groundwater aquifers and shallow coastal zones that it has published revised guidelines for its control. The state of California also has taken actions recently to help mitigate the undesirable environmental effects of AFOs, including the implementation of Waste Discharge Requirements (WDRs) that regulate all types of waste discharges rather than just polluted runoff.

Considering the current size and structure of the California dairy industry as well as pressure for continued growth and consolidation, the revised federal guidelines and the initiatives undertaken by the state could have significant impacts on California's agricultural economy as well as its environment. Thus it seems imperative that these regulations be designed and implemented carefully to avoid visiting unnecessary costs on either producers or the public. This requires understanding both the natural systems affecting the fate and transport of dairy waste, as well as the economic factors affecting producers' decisions about milk production and waste disposal. Although progress has been made with regard to understanding the former, economic analyses of the problem still are lacking. Without such analyses, regulations are unlikely to be designed and implemented cost-effectively.

The objective of this research is to develop a mathematical model for assessing the costs of different groundwater nitrate pollution control alternatives in dairy-intensive watersheds, and for designing policies that achieve nitrate standards cost-effectively. The model will simulate farm-level decision-making, agricultural production, waste generation, and the fate and transport of nitrates within a watershed. It also will be scalable, so that multiple watersheds may be combined into larger hydrologic units for which regional assessments may be performed. Ultimately the framework will illuminate the environmental and economic effects of different regulatory alternatives, thereby helping state policy-makers balance the health of the dairy industry with that of the environment.